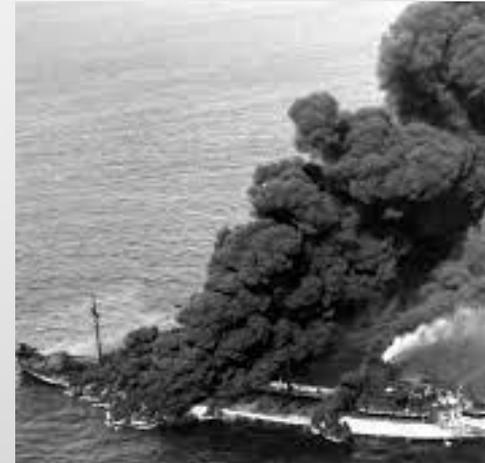
The background of the slide is a light gray gradient with several realistic water droplets of various sizes scattered across it. The droplets have highlights and shadows, giving them a three-dimensional appearance. They are located in the top-left, bottom-left, and bottom-right areas of the slide.

PFAS FROM A MILITARY PERSPECTIVE

BRIG GEN (RET) CHRISTOPHER FAUX
MASSACHUSETTS MILITARY DIVISION

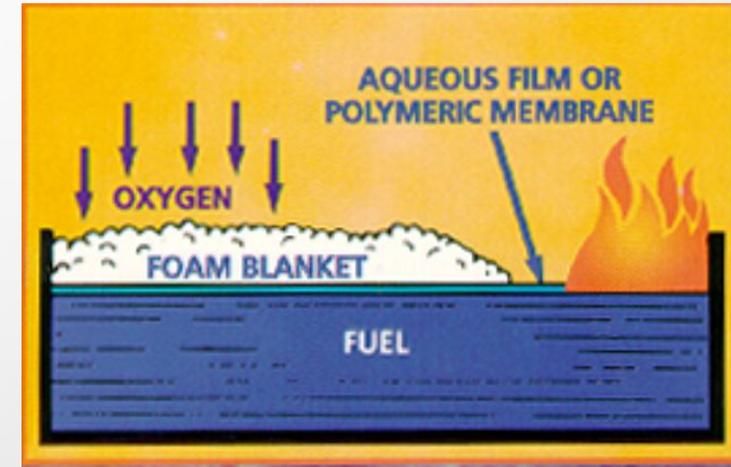
BRIEF HISTORY OF AQUEOUS FILM FORMING FOAM

- The first firefighting foam was developed in 1902 by Russian engineer & chemist Aleksandr Loran or the petroleum industry as a means to extinguish fires by “blanketing and smothering”
- Early 1960’s, Naval Research Labs (NRL) partnered with 3M to research synthetic chemicals to better handle class “B” fires (flammable and combustible liquids) concentrating on C8 per and polyfluoroalkyl substances (PFAS)
 - Perfluorooctanoic Acid (PFOA –used for Teflon©)
 - Perfluorooctanesulfonic Acid (PFOS – the main component of Scotch Guard ©)
 - Led to the development of the first formulation of AFFF, which remained unchanged for decades



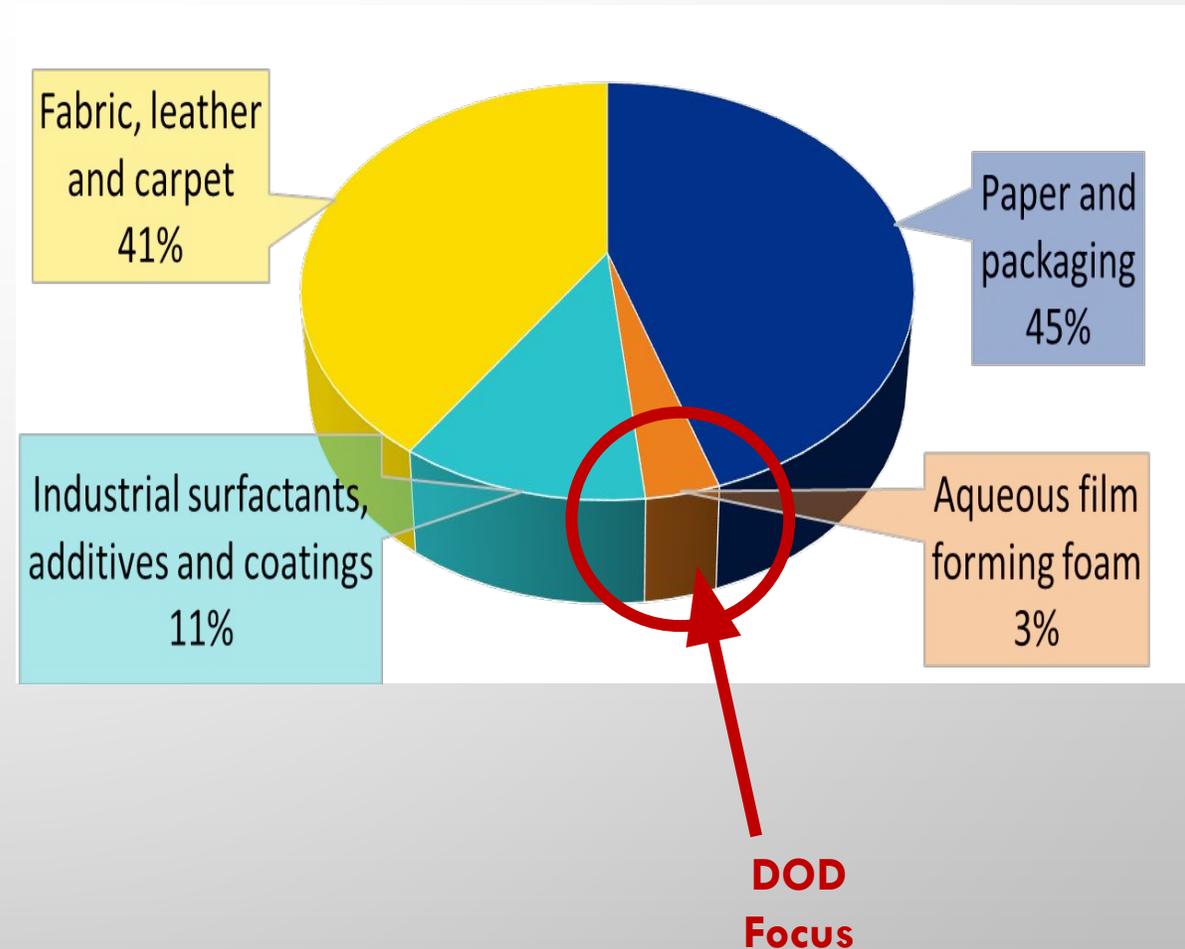
BRIEF HISTORY OF AFFF (CON'T)

- AFFF: Fluorocarbons, surfactants and solubilizers
 - The fluorochemical based surfactant reduces the surface tension of water allowing the foam to form an aqueous film on the surface of the hydrocarbon fuel that prevents flash/re-ignition by
 - Suppression of vapors,
 - Deprivation of oxygen to the fuel surface, and
 - Prevention of evaporation and subsequent re-ignition of the fuel
- AFFF Becomes the Naval Standard by the late 1960's and the military standard by the early 1970's- universally identified as “the most effective agent seen to date for hydrocarbon fuel fires (and spills) “
- Military Specification (MILSPEC) MIL-A-24385 (?) eventually becomes the standard for all FAA Part 139 airports (based upon # passenger/scheduled flights)



DOD PFOS/PFOA CONCENTRATION

- PFAS are present in consumer products....
- More prevalent on DOD installations due to volume/frequency of use at identified fire training areas (FTA)
- Other DOD sources include actual fire emergencies (military and mutual aid), fuel spills, hangar fire suppression system releases and equipment calibration



FIREFIGHTER TRAINING AND FIREFIGHTING

Training

- Normal frequency using AFFF and Fuel was a minimum an annual training event...no data on volume per event
 - Multiple events to capture all- not uncommon to train more frequently
- Small release: vehicular calibration, involving a Ph test of water, a manufacturers test kit for foam concentrate and a small release of foam (@ 3% water/concentrate mix)
- AFFF/Fuel training ceased in 1985

Foam Change

- Complete change from C8 to C6 foam in the 2015 timeframe
- Trucks now equipped with internal self calibration modules that provide data to a cockpit panel and release no actual concentrate or foam
- C6 foams do not meet MA PFAS6 ?

Actual Firefighting

- No known actual crashes during AFFF lifetime
 - Fuel spills- include two separate incidents near Otis Rotary (main entrance) -one military/ one mutual aid
 - Source of plume – Impacting Hen Cove and other areas – shell fish study identified for future
 - FTA-1 Source Treatment (low temperature thermal desorption) – caught fire
 - Unintended Releases- Fire Suppression Systems
- All product treated as HAZMAT...no longer just the fuel, with hyperawareness of volumes employed

FIRE FIGHTER FOAM TRAINING



INADVERTENT SYSTEM RELEASE

(PICTURE IS HIGH EXPANSION FOAM (HEF), NOT AAF)

- Uninitiated releases were not “uncommon”
 - Sensor failure key issue
 - Deluge-Once started, could not be stopped!
- USAF no longer uses AFFF in suppression systems
 - HEF/Halon systems for interior use
 - Equipment spread vs lifesaving



COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT (CERCLA) VS. DEFENSE ENVIRONMENTAL RESTORATION PROGRAM (DERP)

- CERCLA enacted in 1980 & updated in 1986 by the Superfund Amendment and Reauthorization Act (SARA)
 - Applies to DOD with the exception of funding
 - DOD not authorized to utilize the "Superfund"
- DOD enacts DERP in 1986 to identify corresponding roles from DOD components
 - Established Defense Environmental Restoration Account (DERA), now known simply as environmental Restoration Accounts (ERA) , allocated to each service component....DOD Superfund equivalent
- DERA funding utilized for all investigation and clean up activities starting in 1986, but the **National Guard (NG) was effectively cut off from ERA funding in 2017**
 - The Assistant Secretary of Defense for Energy, Installation and the Environment, the Honorable Lucien Niemeyer, released a memo stating that installations not owned and operated by DOD were only allowed to utilize DERP funding to conduct investigative activities up through the Site Inspection (Assessment) phase of CERCLA. NG sites where DOD is/was the owner operator (Otis) could apply for a waiver directly through his office. First round of waivers were denied.
 - NG lobbied and employed CODEL to make changes via annual National Defense Authorization Act-incremental return of capability- FY21 NDAA most promising to date
 - All PFAS (PFOS/PFOA) only sites have completed waivers for DERP inclusion, with many approved
 - Comingled (PFAS and Legacy contamination) scheduled to undergo process in FY22

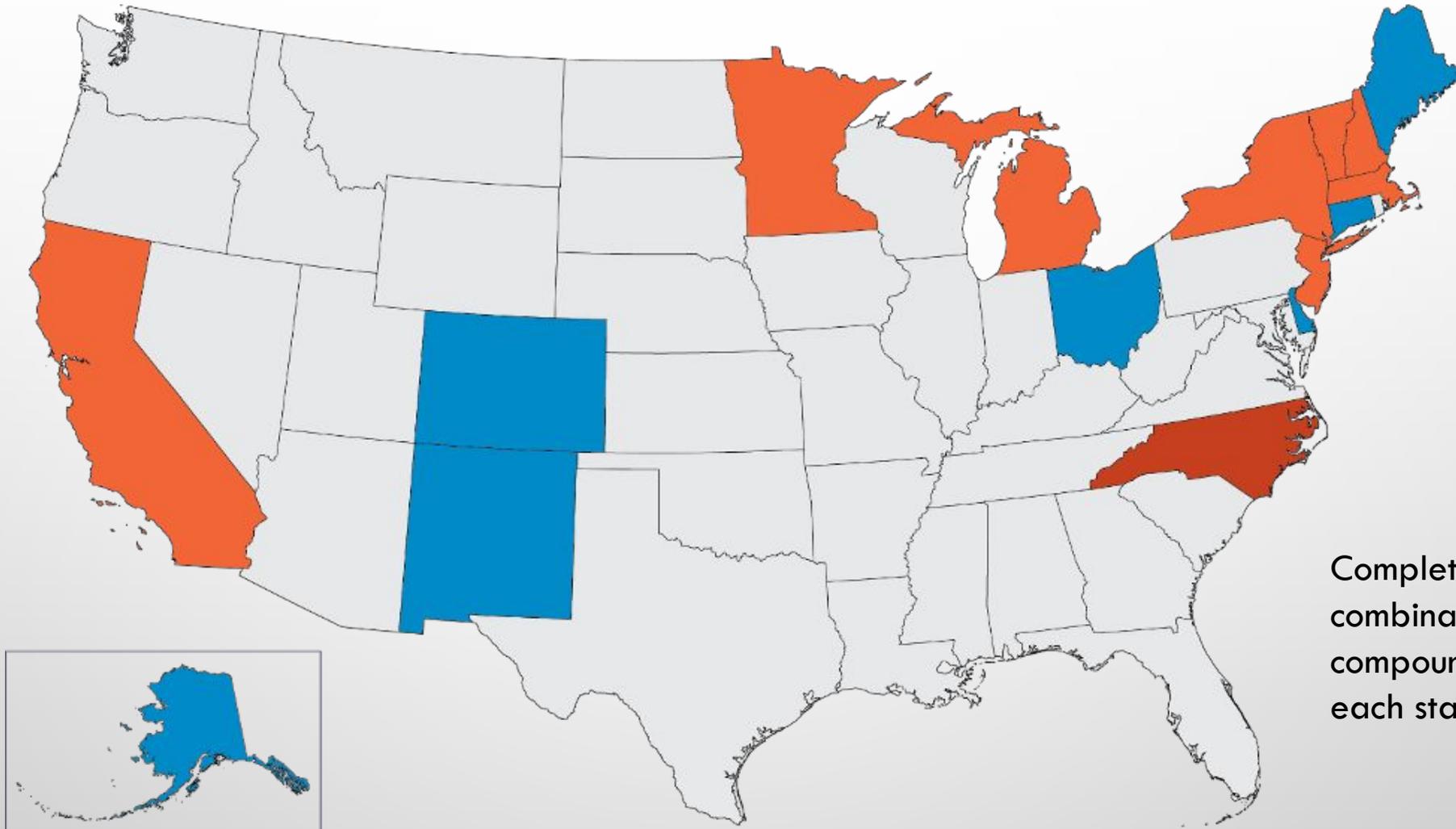
EPA LIFETIME HEALTH ADVISORY (LHA) VS PHAS6 MA MAXIMUM CONTAMINANT LEVEL

- EPA has not established national primary drinking water standard/regulation for PFOS/PFOA, only an LHA of 70 ppt
- Sep of 2020: MA DEP Issues the MA Maximum Contaminant Level (MMCL) for the PFAS6 Compounds of 20 ppt, effective 2 Oct 2020
 - PFAS6 refers to PFOS, PFOA, PFHxS, PFHpA, PFNA and PFDA in a combined concentration greater than or equal to 20 parts per trillion
- DOD policy is to ensure everyone affected has clean drinking water....as defined by the LHA!
- For DOD, the controversy appears when concentrations between 20 and 69 ppt are identified and where ARARs come into play.....

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENT (ARAR)

MA PHAS6 as an ARAR?

- CERCLA requires evaluation of more stringent state standards during the Site Specific Feasibility Study (FS)
 - Personally viewed as the most important phase of the CERCLA process for.....CODELs, municipalities and the public....as it relates to ultimate water quality!
- Joint Base Cape Cod as an example
 - 28 Oct 2020- MA DEP sent a letter to the Air Force Civil Engineering Center (AFCEC) requesting the Air Force (AF) accept the PFAS6 MMCL as an ARAR
 - Similar letter sent for Barnes ANG Base-same timeframe
 - 22 Feb 2021- AFCEC responded stating that it will include the PFAS6 MMCL in the site specific ARAR evaluation for JBCC groundwater during the FS, and would continue to provide response actions (bottled water/filtration systems) for drinking water impacted by PFOS/PFOA **above the LHS**
 - Discussed in June 2020 letter from NGB
- Negotiated outcome will be documented in the Record of Decision (ROD)
- So why is this tricky....



Completely different combination of PFAS compounds and limits in each state

- States that have adopted a standard lower than 70 ppt
- States that have adopted a standard equal to 70 ppt
- States that have adopted a standard higher than 70 ppt
- States that have not regulated PFAS in drinking water

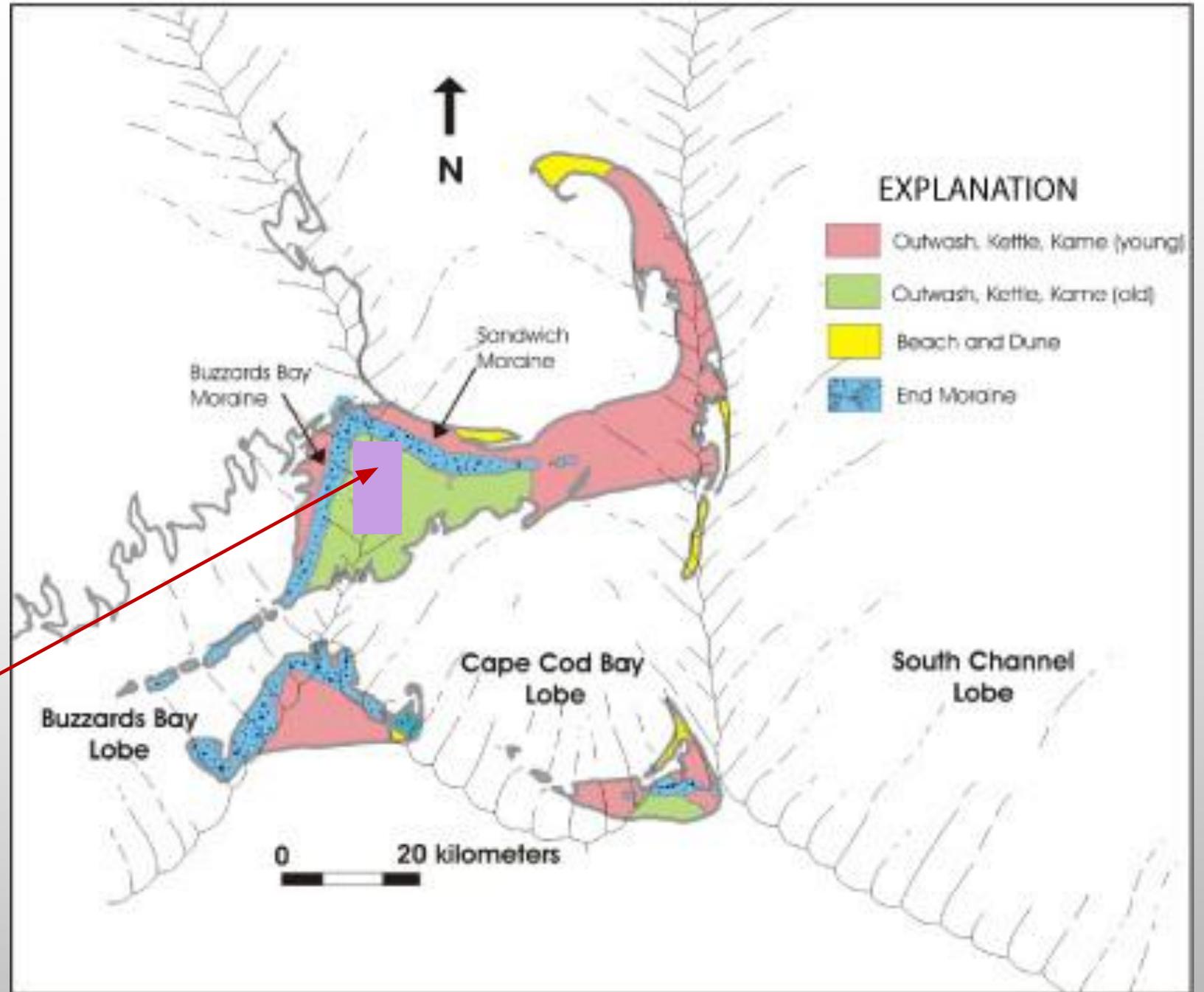
JOINT BASE CAPE COD (JBCC)

- JBCC is comprised of multiple military facilities and commands
 - Otis Air National Guard Base (MA Air National Guard)
 - Camp Edwards (MA Army National Guard)
 - Air Station Cape Cod (US Coast Guard aviation component)
 - Base Cape Cod (US Coast Guard support component)
 - US Space Station Cape Cod (6th Space Warning Squadron of the US Space Force)
 - Multitude of additional sub-components
- Greatest familiarity is with Otis, which will be the subject of the details of the contamination discussion

Cape Cod Geology 101

- Although JBCC skirts the moraine on the western and eastern borders, the vast majority of the installation lies within the outwash
- Basically a significant depth of sand before hitting bedrock...100s of feet in some cases
- Groundwater flows at 1-2 feet per day

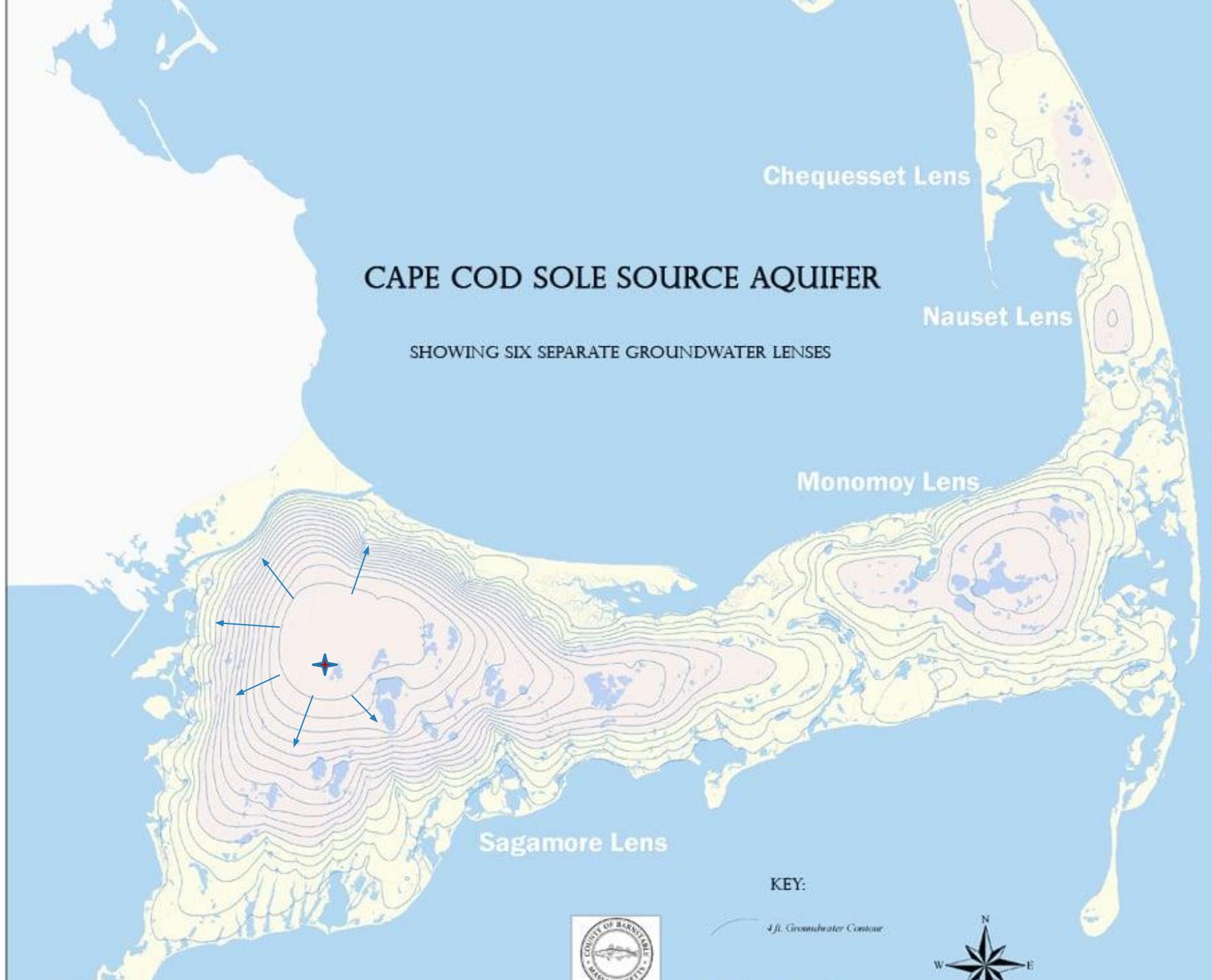
Approximate Area of JBCC



Groundwater Flow

Water flows perpendicular to contours...creating a "mound" under JBCC from which groundwater flows radially

✦ This symbol is an attempt to orient this and the following slide



Legacy Contaminant Plumes

Representing the furthest reach of each plume

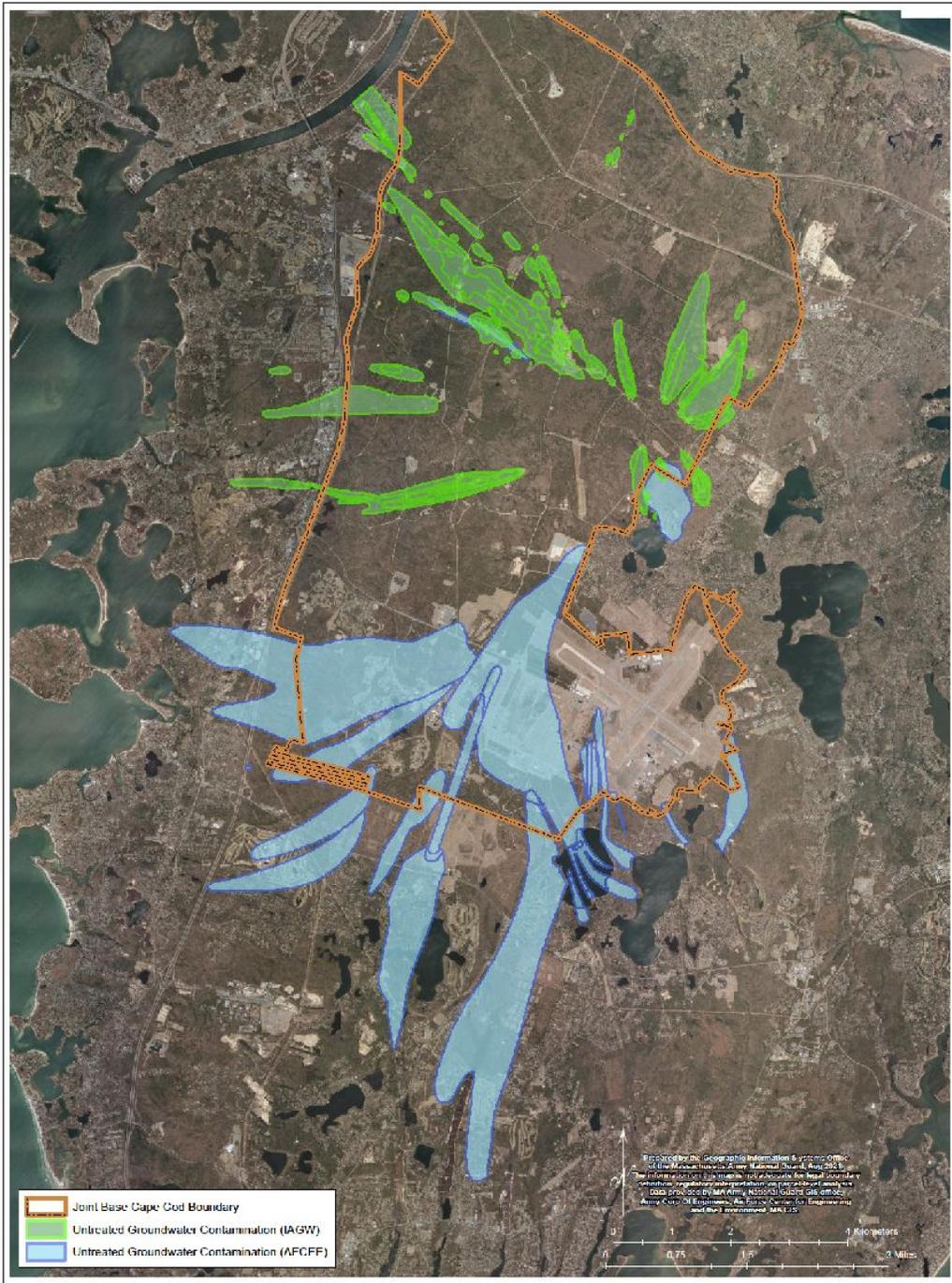
Green represents contamination being addressed by the Army's Impact Area Groundwater Study Program
Primarily explosive compounds and solvents

Blue represents contamination being addressed by the Air Force via the Air Force Civil Engineering Center (AFCEC)
Primarily fuel compounds and solvents

Normally , contamination on Air National Guard Bases is handled by the National Guard Bureau (NGB), such as at Barnes ANG Base.

However, the sheer scope of the issue and the fact that Otis is a former Air Force Base, led to an agreement between the AF and NGB for AFCEC to oversee the Installation Restoration Program (IRP) on Otis ANG Base.





PRE-PFAS WATER SUPPLY ACTIONS

Prior to identification of PFAS Contamination, The Installation Restoration Program spent millions of dollars....

- Providing bottled water to homes (private) with identified legacy contamination
- Installing whole house treatment systems
- Installation of significant infrastructure to hook homes up to clean municipal systems
- Installing a series of wells in the northern part of JBCC, connecting appurtenances and individual (by town) facility for treatment/distribution to supply clean water to the four surrounding towns, known as the Water Co-Op
- All sources routinely checked to monitor progress...

EXAMPLES OF DERP RESTRICTION IMPACTS

Otis Trailer Village Well

vs

Mashpee Water District (Turner Road Wells)

- Small, private system
- Contamination exceeded LHA
- Remedial design approved, funding received prior to ANG's restriction to DERA funding (FY17)
- Situation above prompted swift intervention by Congressman Keating via DASD for Environment Ms. Sullivan, using O&M \$

- Part of a municipal well system
- Contamination exceeds MA PHAS6, but not LHA
- Awaiting remedial investigation, pending DERP waiver approval- comingled site FY22
- Filed a letter identifying intent to sue (\$8.5M) if funding not received*

*NOTE: Law Suits automatically bring Department of Justice (DOJ) into the picture

OTHER EMERGING CONTAMINANTS (EC)

- 1-4 Dioxane, although not as prevalent, has also been detected
 - Stabilizer in solvents
 - Additive to soaps/emulsifiers
- What is next????
 - EXTREMELY important as it relates to future recommendations and the language of future appropriations
 - Unless there is a variable that obviously eliminates federal responsibility, the National Guard needs the same , unfettered access to (D)ERA funds as their active duty counterparts
 - Guard operations are 100% federally funded (including fuel and foam)
 - Operation aviation missions, unless performing specific State Active Duty, are under the direction of the service component
 - ALL Guard PFAS contamination is associated with firefighting, which federally mandated and regulated

Only way to ensure the next EC, and there will be more, does not become PFAS 2.0!

RECOMMENDATIONS

- #1 - Reversal of the Niemeyer Memo
 - National Guard Association of MA/US have been working closely with CODELs to include changes in the national Defense Authorization Act
 - Strong lobby representing “The 54”
 - MA National Guard needs to keep members of the General Court up to speed to help synchronize efforts
 - Avoid “piece meal” approach
 - Pay close attention to the cue for each stage in the CERCLA process....RI is the most critical step
- Closely follow ARAR process
 - Letters to/from DEP to NGB and AFCEC identify the ARAR process and commitment to following the associated CERCLA guidelines....already a great start